

Genetics, Geography, and Satellites:

From genes to space



Dr. Emil A. Cherrington

NASA SERVIR SCO / UAH ESSC

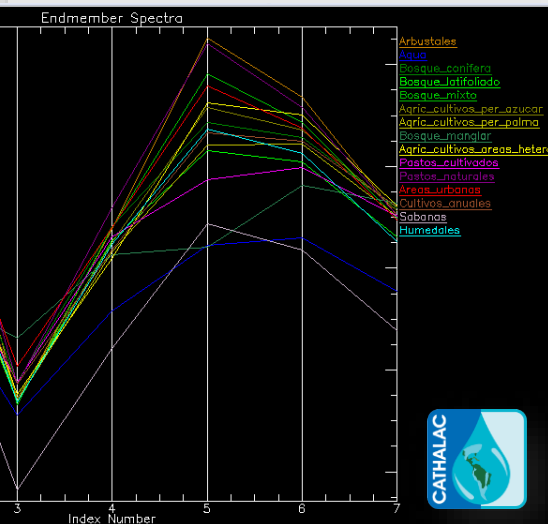
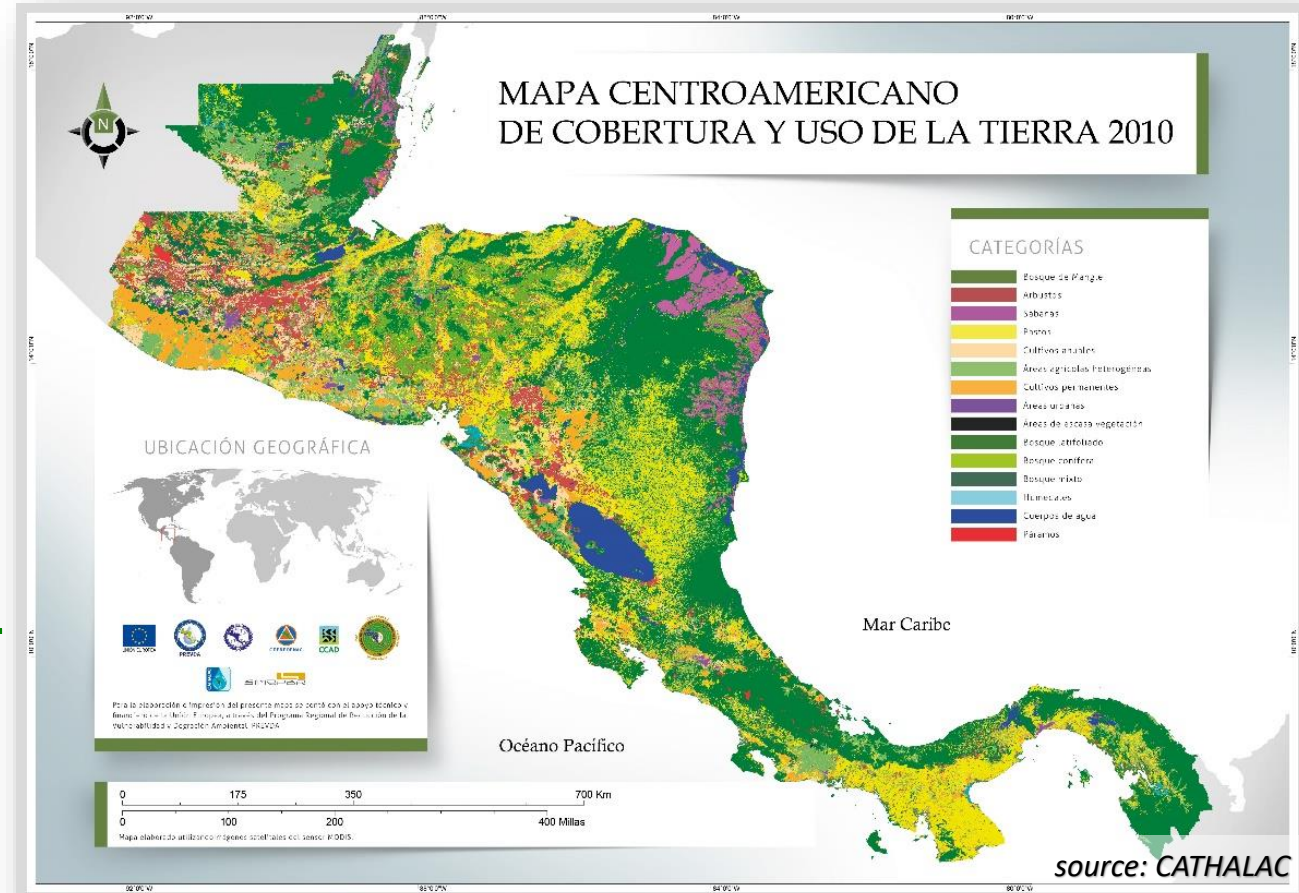
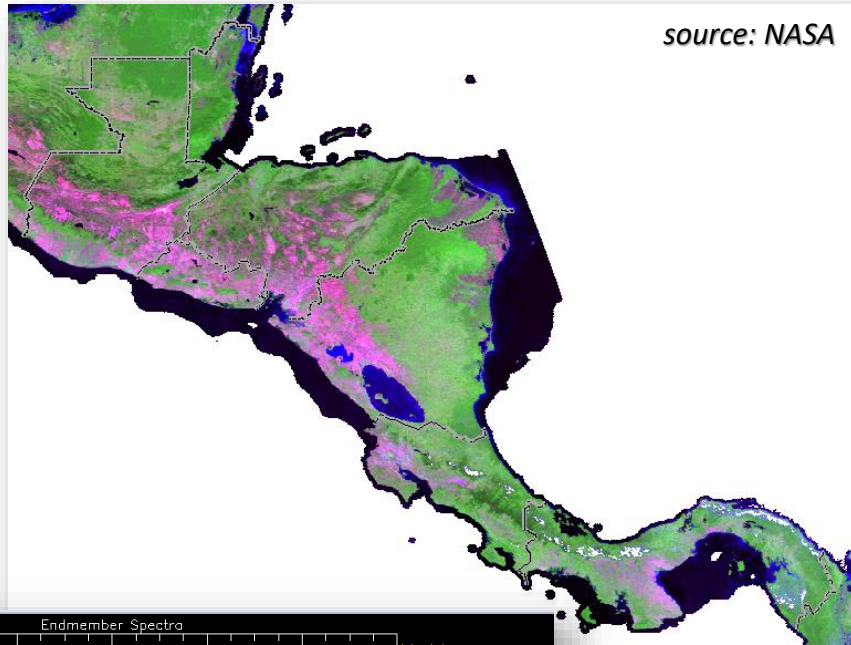
SERVIR 



Ignite 11.10.17

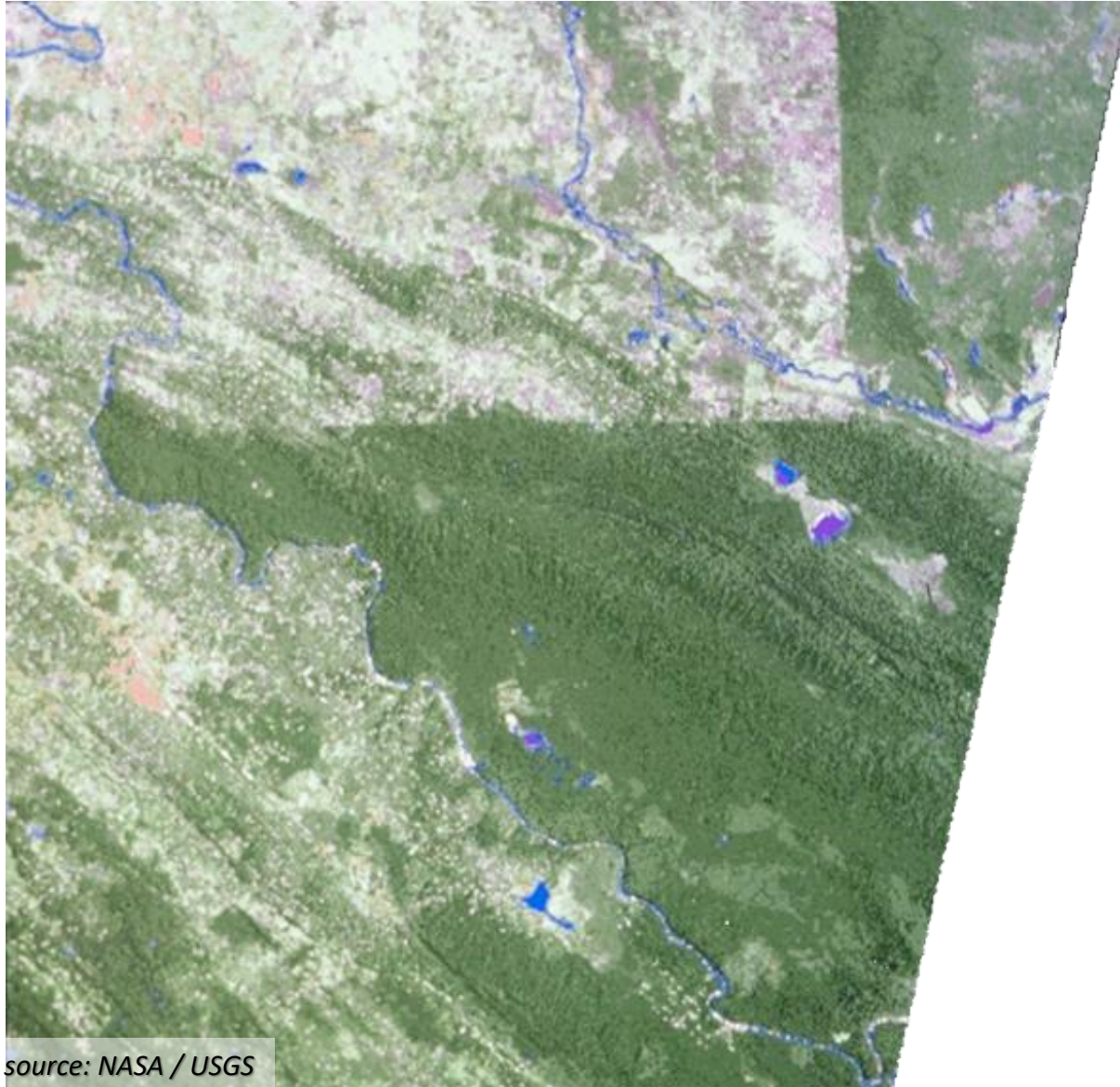
PT1: Land cover has always been a focus of SERVIR

2

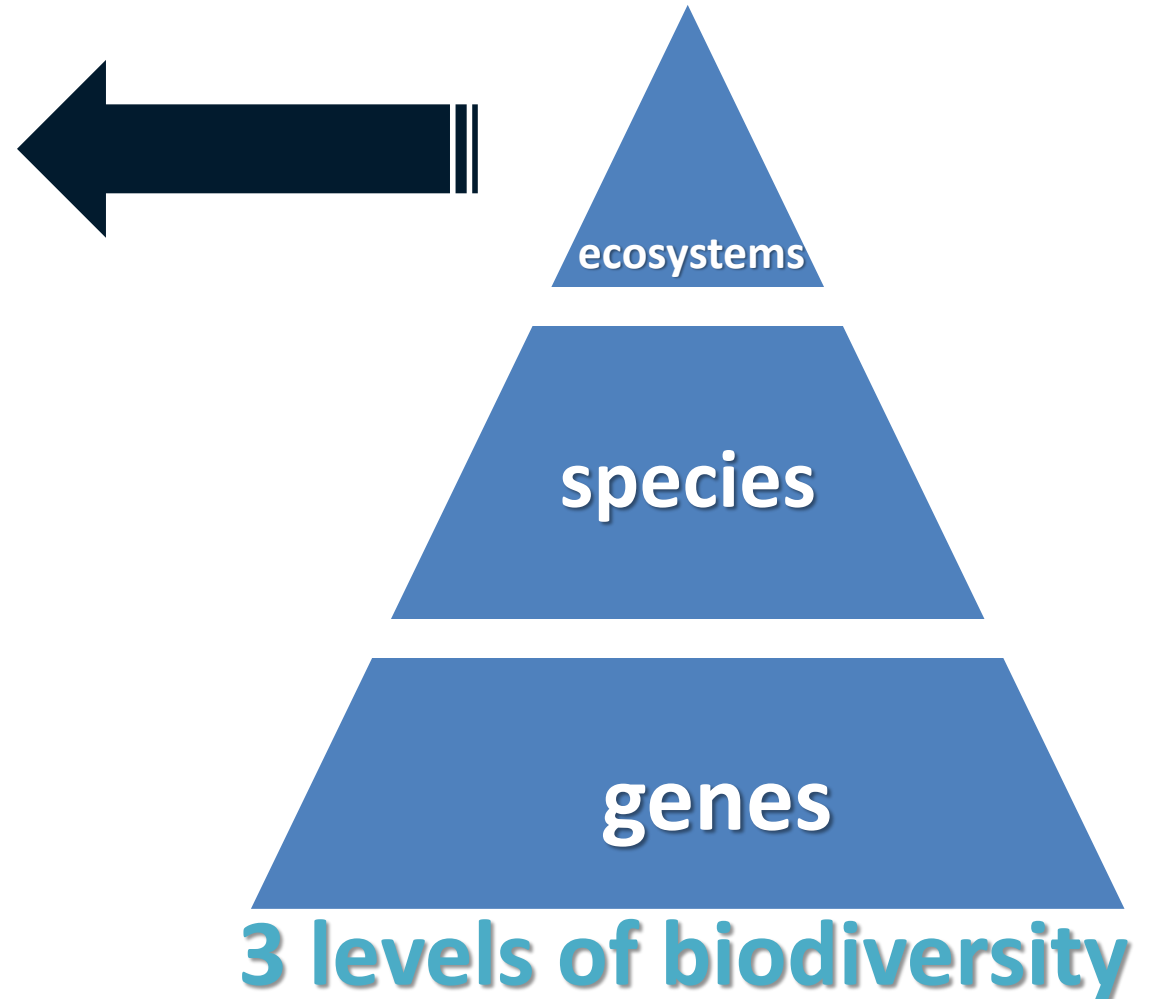


Genes to species to landscapes (ecosystems)

3

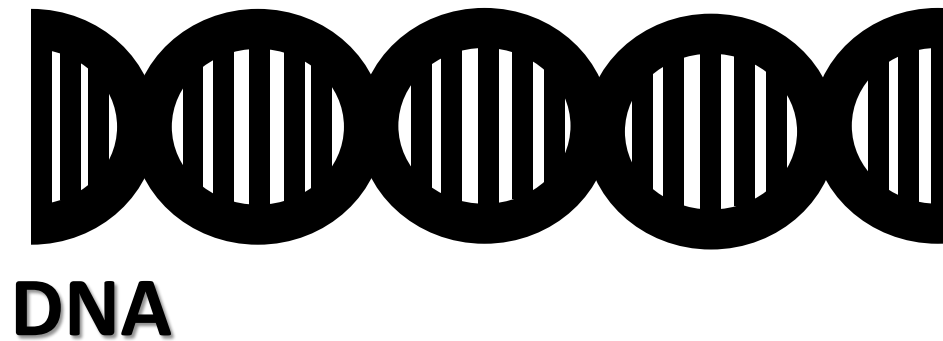
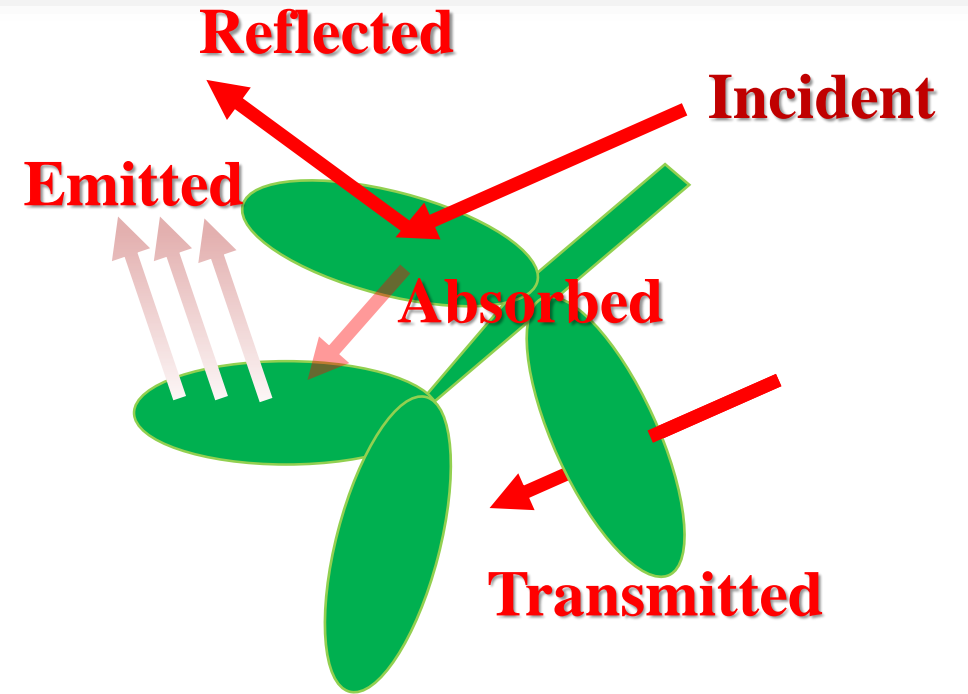
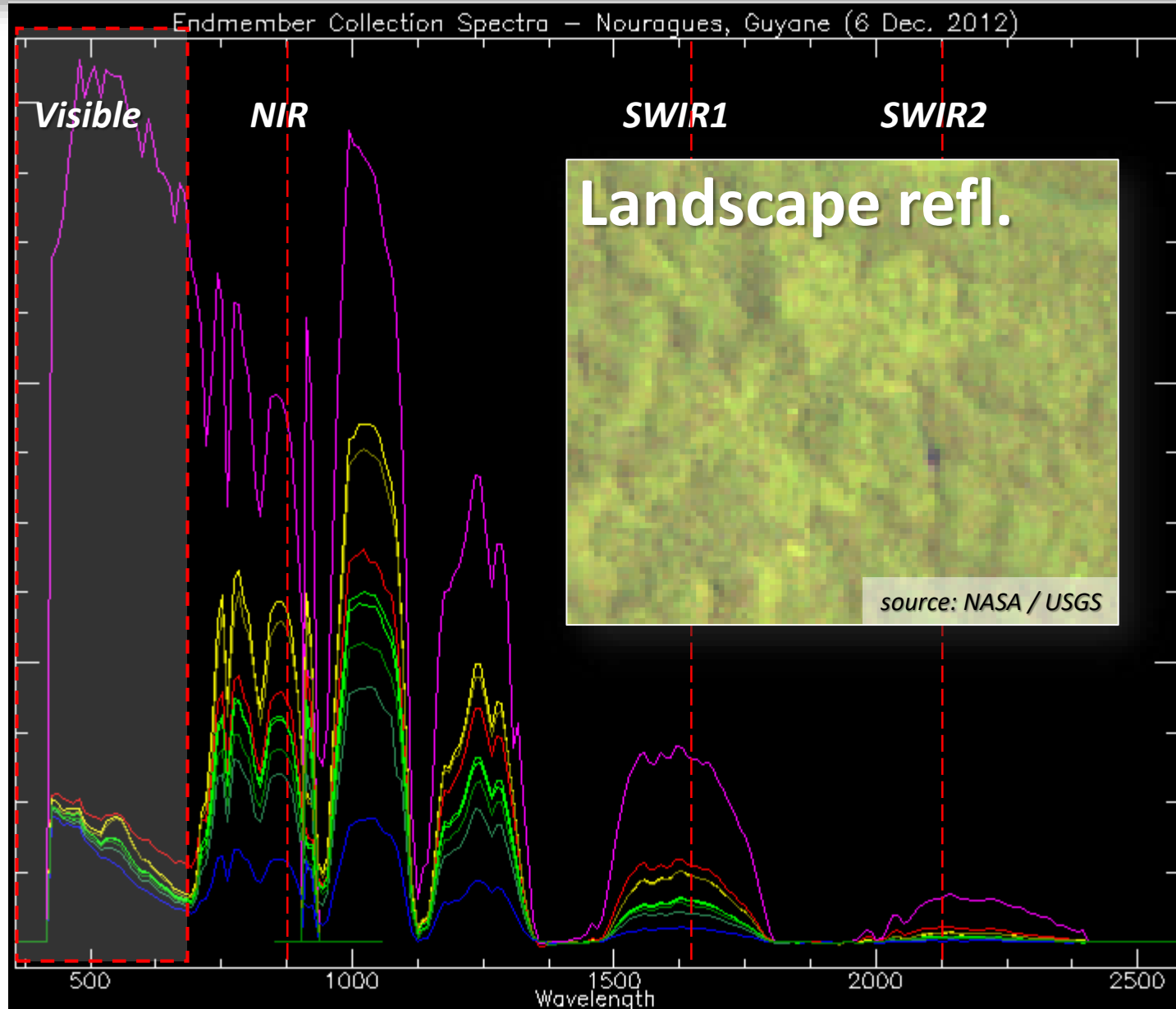


*Thematic area: Land cover,
land use, and ecosystems*



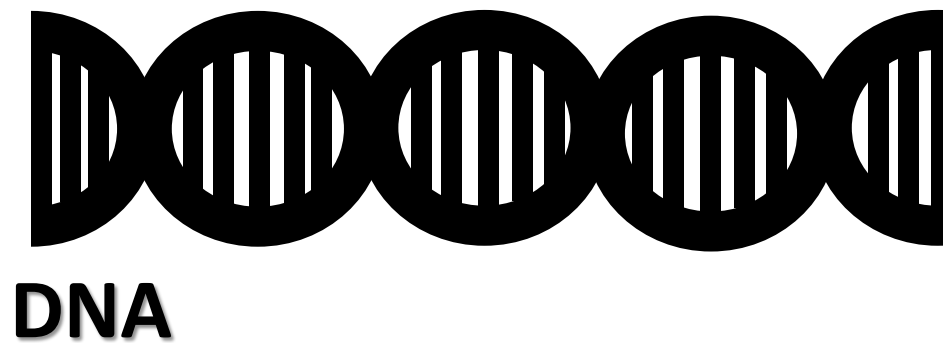
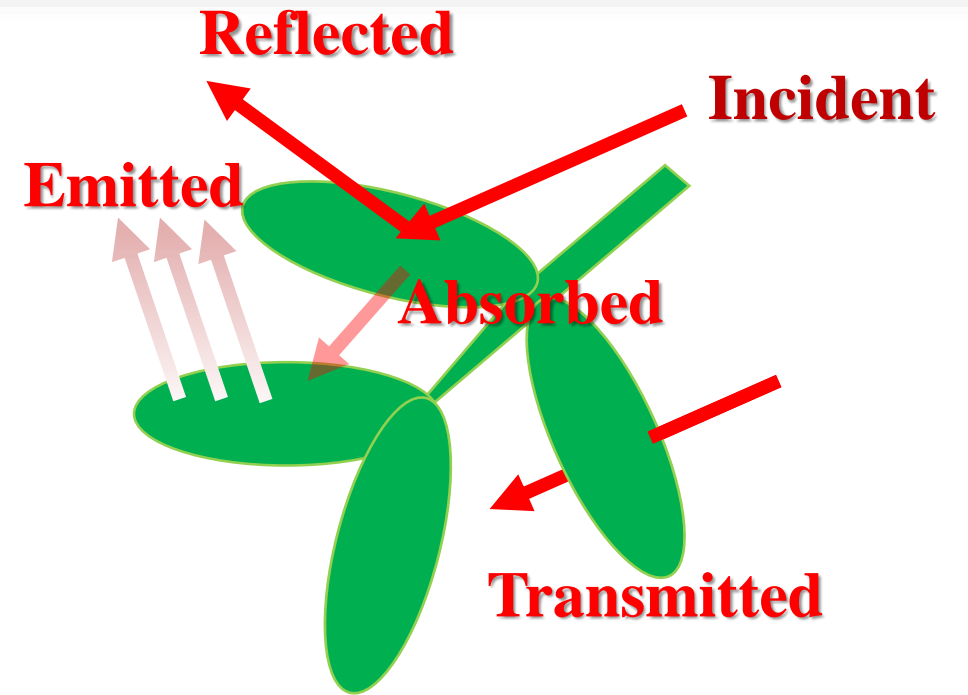
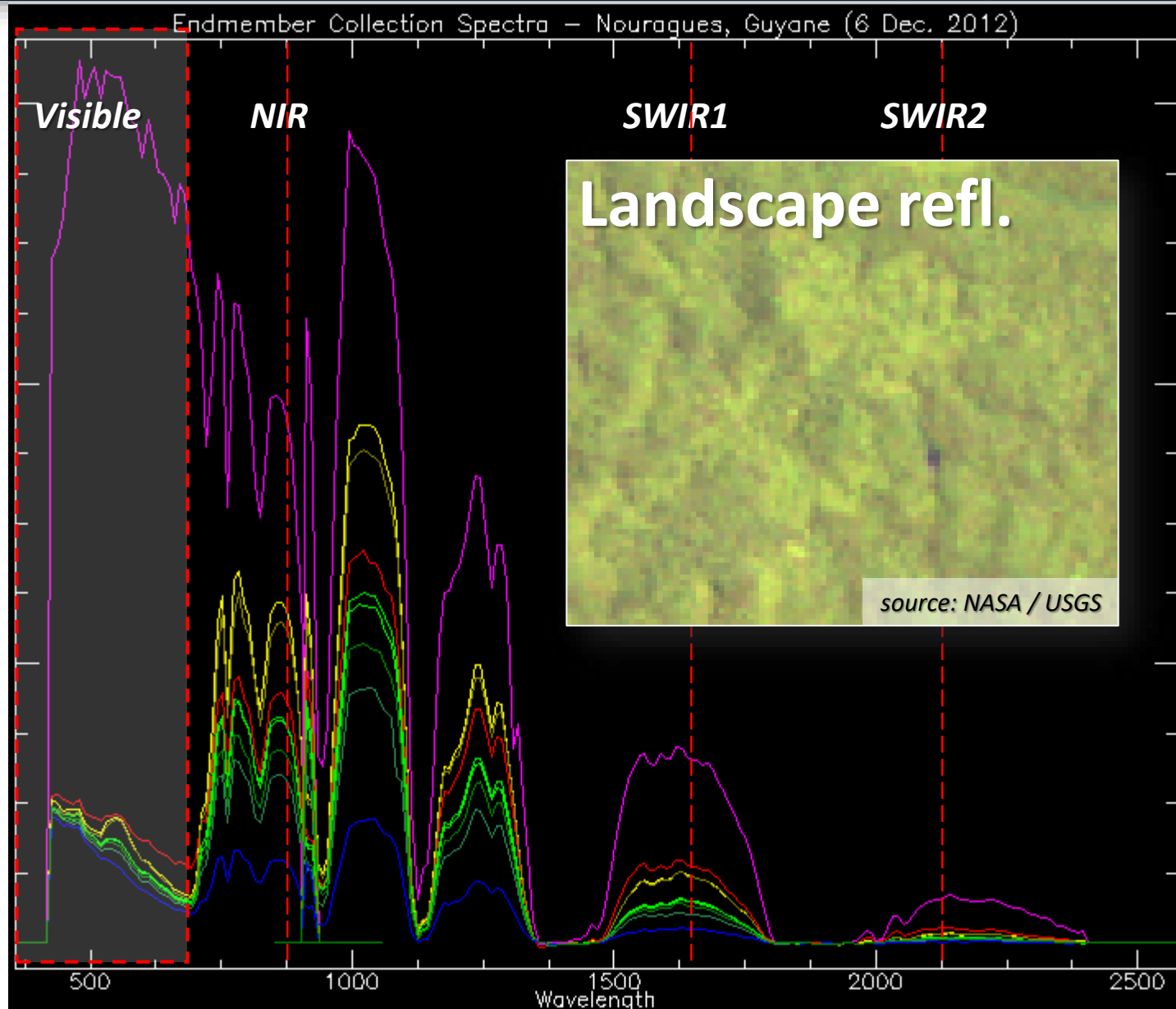
Veg. landscapes are partly the expression of tree-level genetics

4



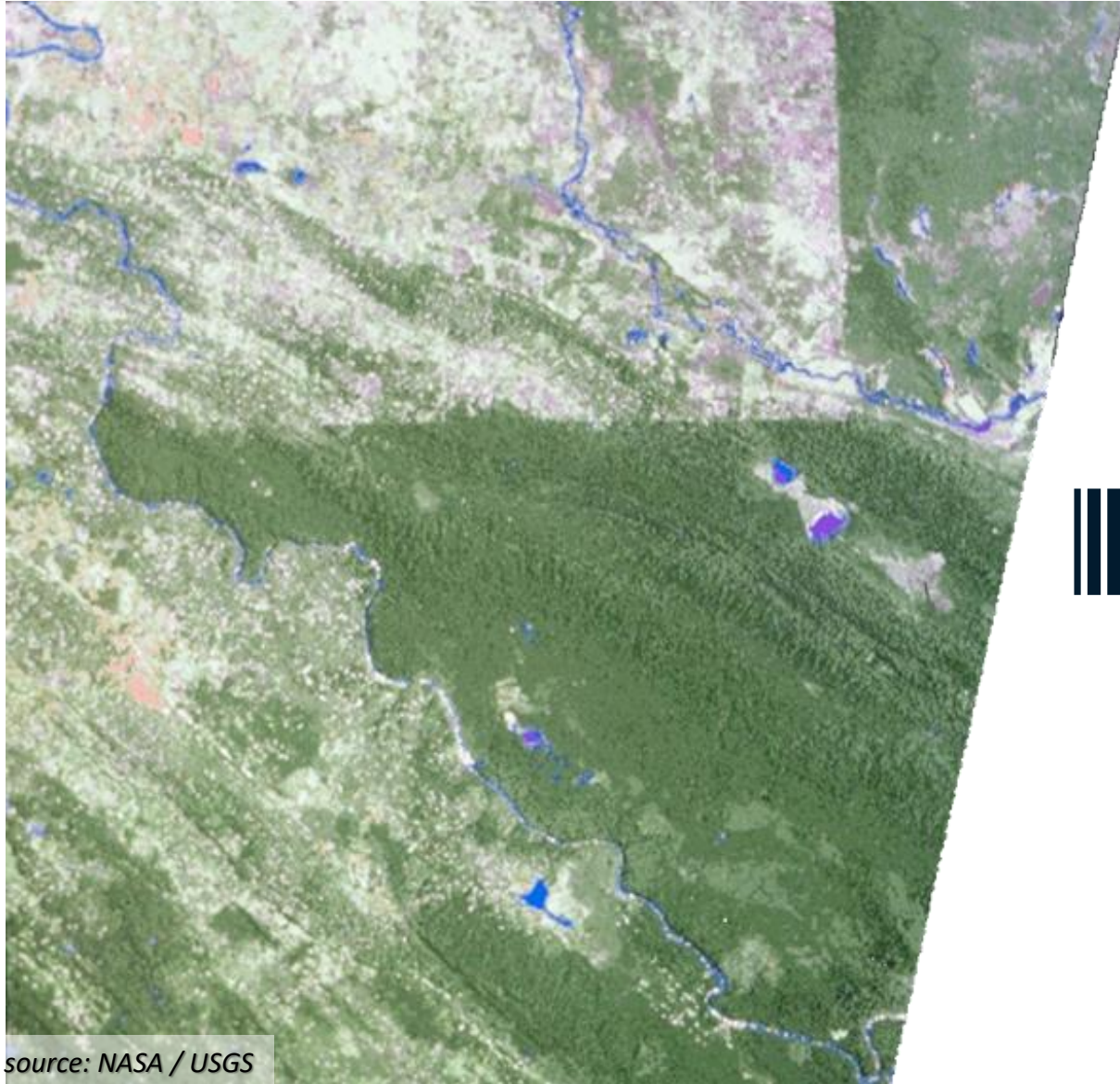
Veg. landscapes are partly the expression of tree-level genetics

5



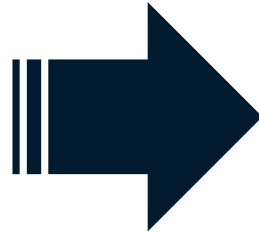
A promising, 1st of its kind program...

6



source: NASA / USGS

Keeping an Eye on Central America



April 23, 2004

Joining the SERVIR family

7



SERVIR-Mesoamerica team in 2009



Feb. 3, 2005

PT 2: GLCF was only source of free Landsat data pre-SERVIR

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Global Land Cover Facility
www.landcover.org

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Welcome

The GLCF is a center for land cover science with a focus on research using remotely sensed satellite data and products to access land cover change for local to global systems.

Download Data

ESDI

GLS Data

2000
Path: 227 Row: 088 Brazil
Landsat Treecover
Data Gallery

2005
Path: 227 Row: 088 Brazil
Landsat TreeCover
Data Gallery

News

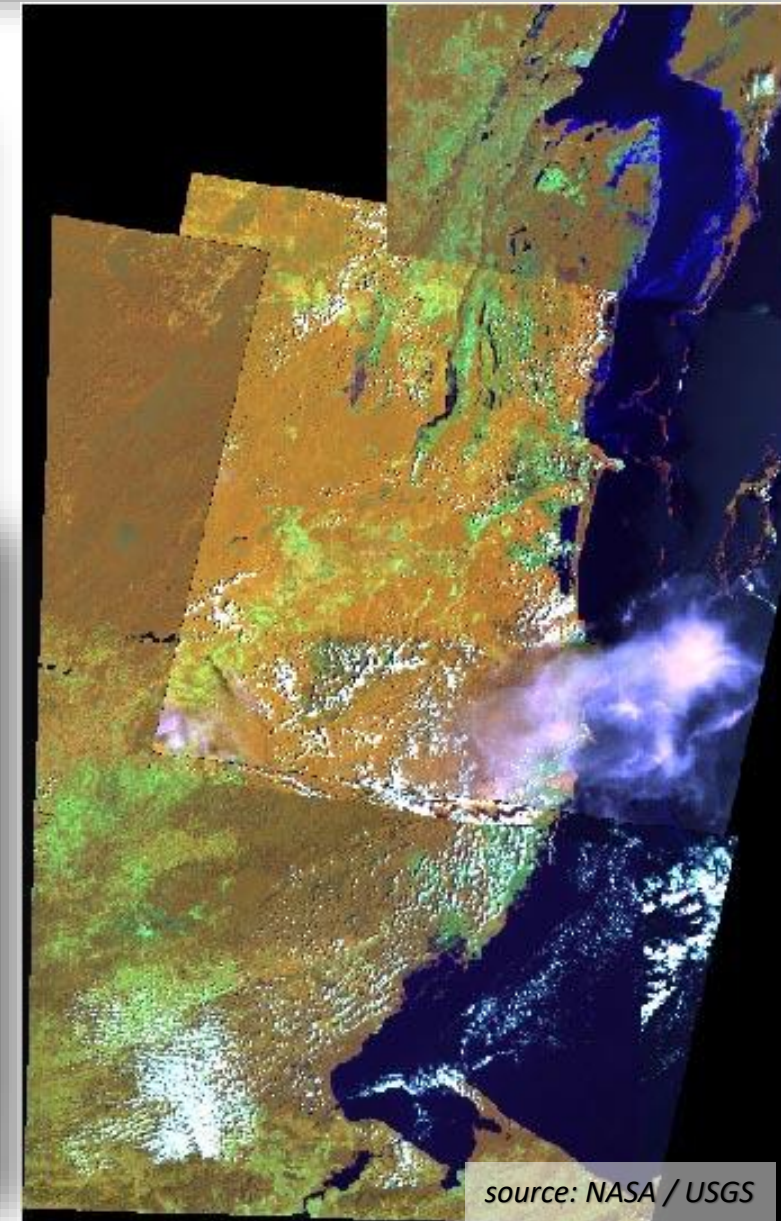
- Paper published in IJDE (2017.04)
- Paper published in Wildlife Society Bulletin (2017.04)
- Paper published in Nature Communications (2017.03)
- 2015 Water Freque
- Paper published in
- 2015 Tree Cover B

www.landcover.org



USGS

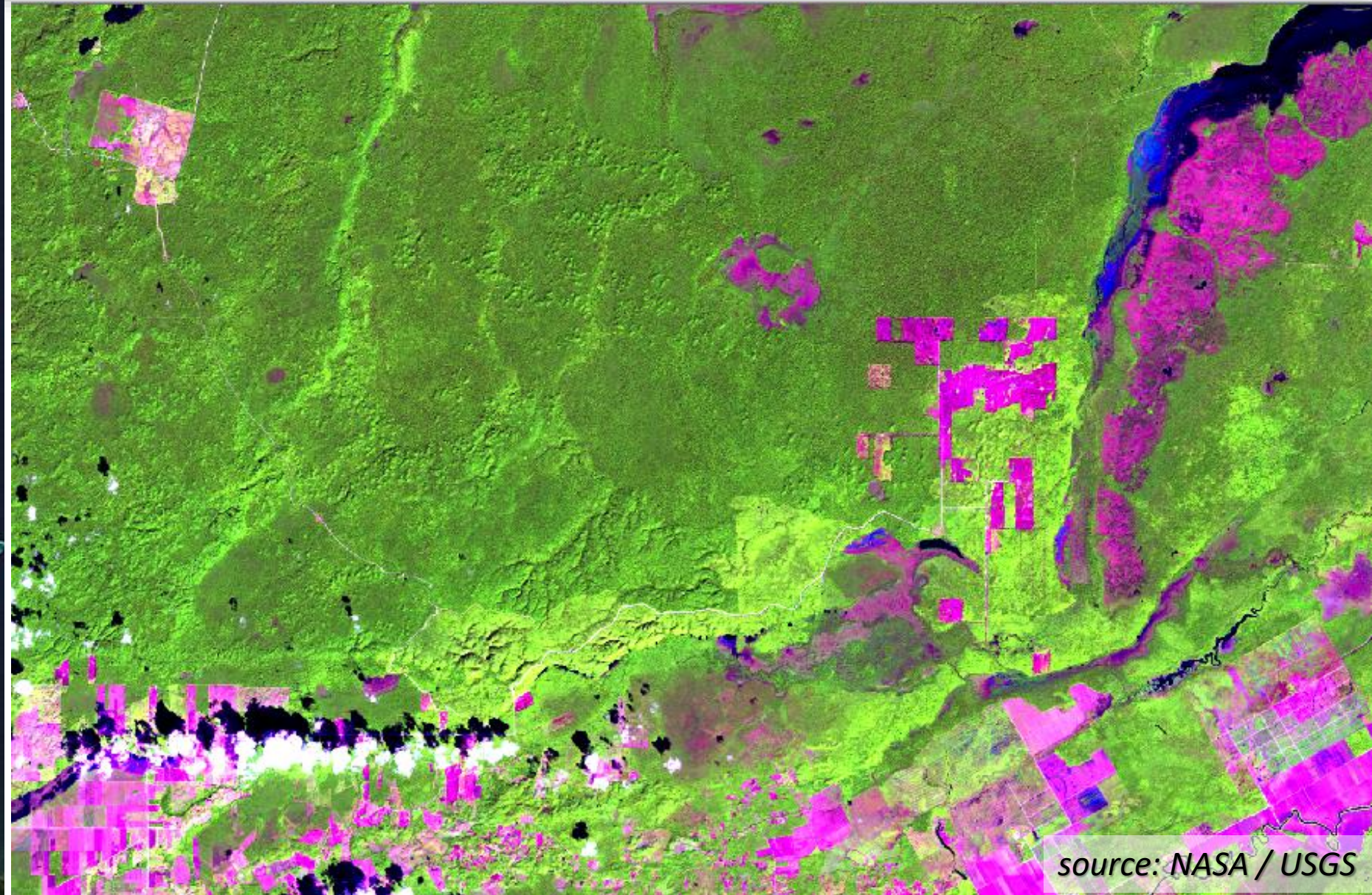
source: NASA / USGS



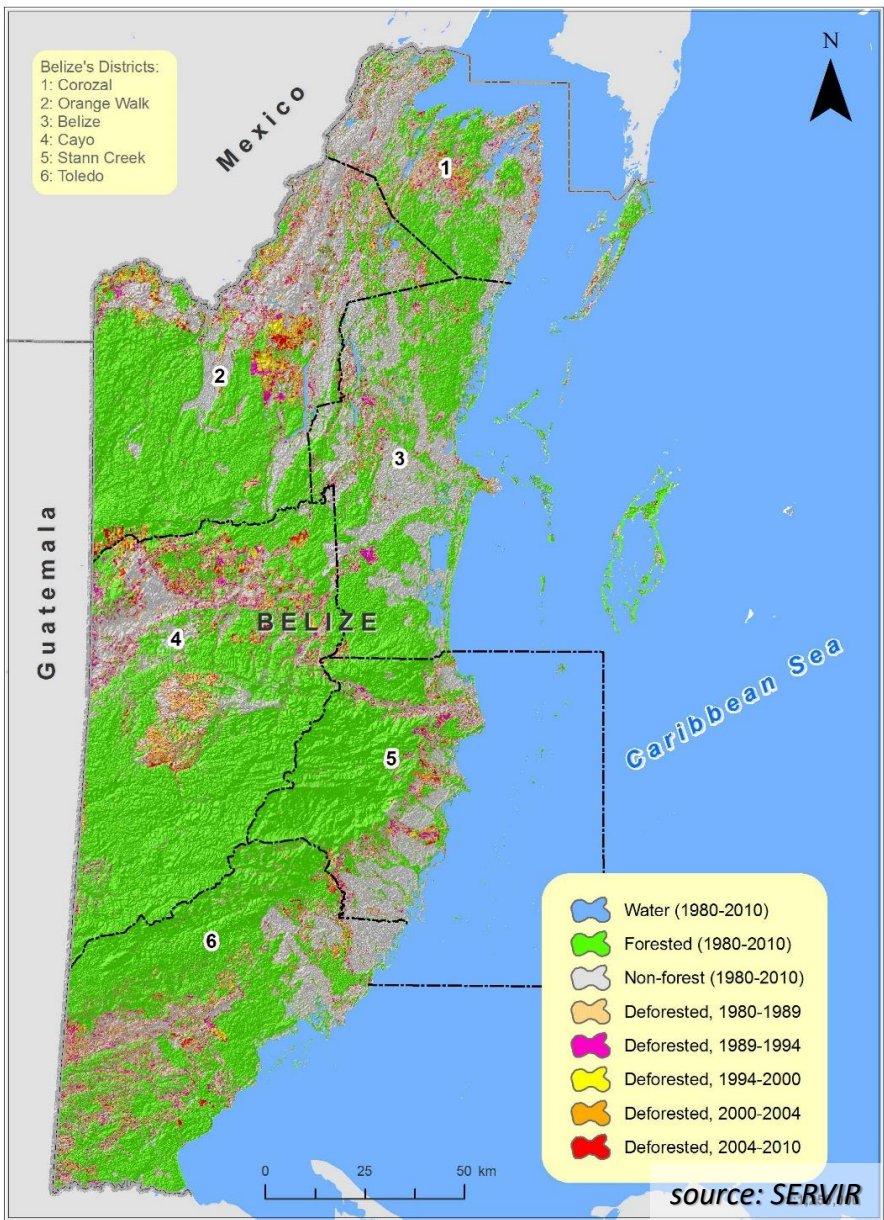
source: NASA / USGS

Satellite images are beautiful, complex data puzzles

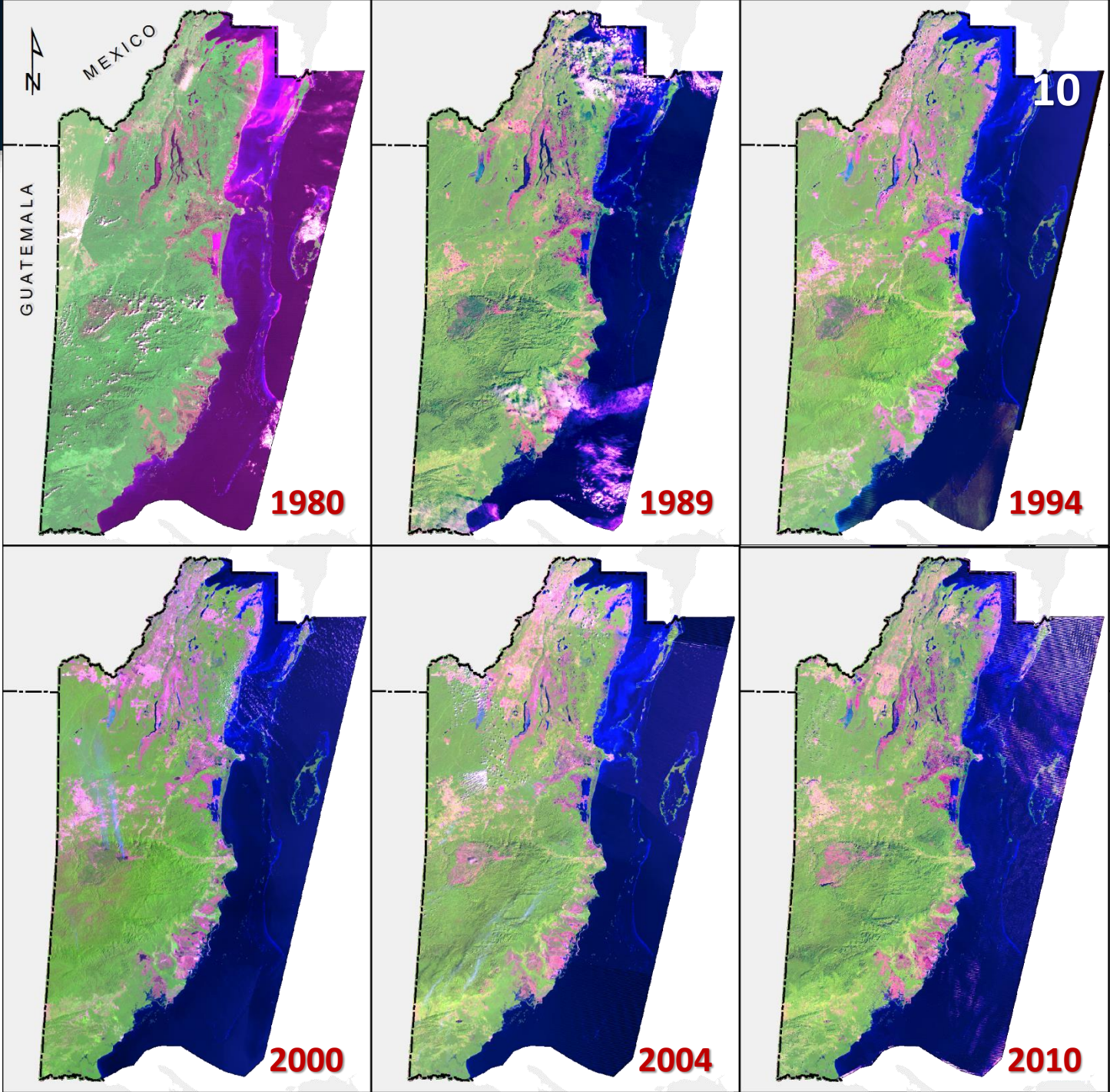
9



From data to information

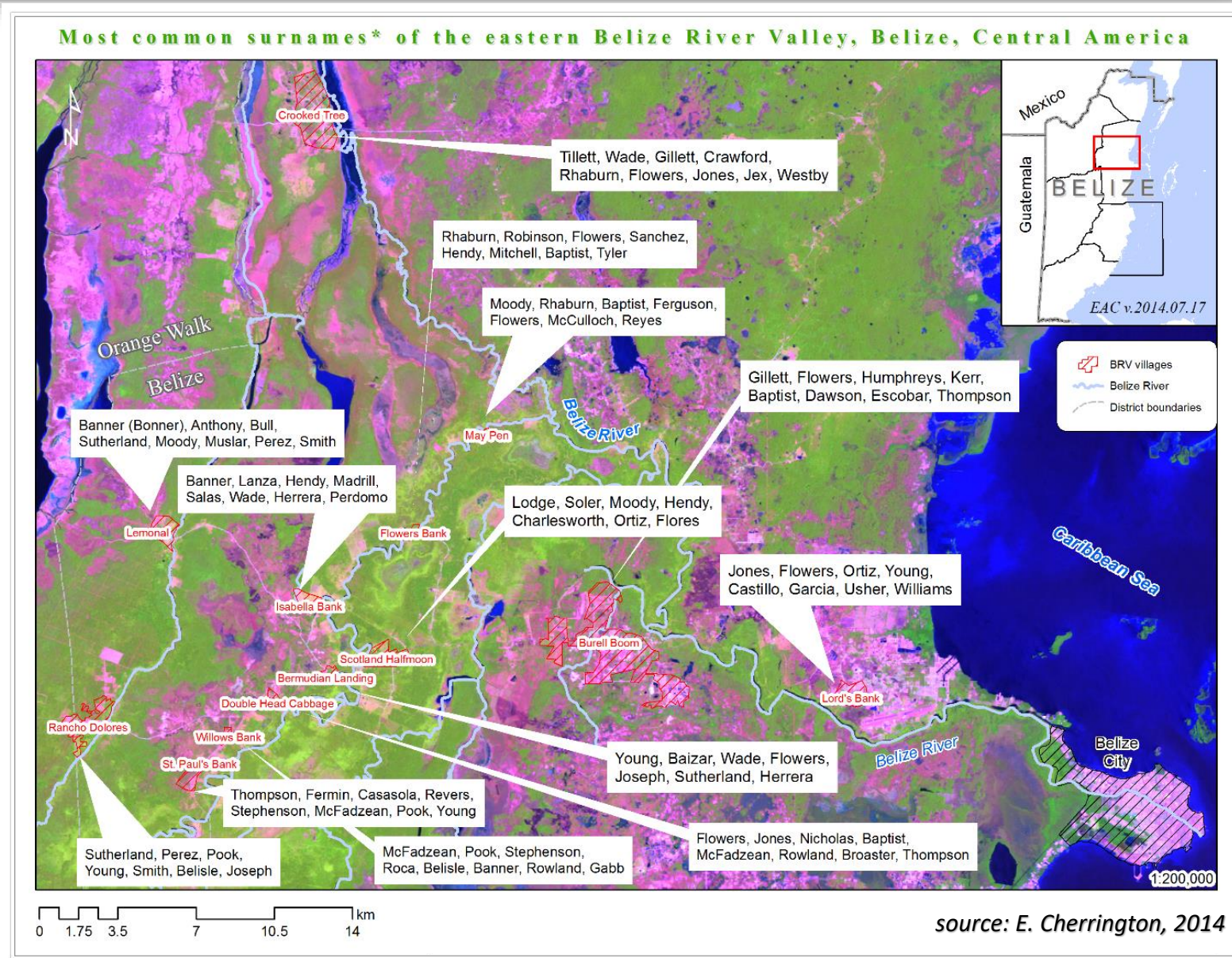
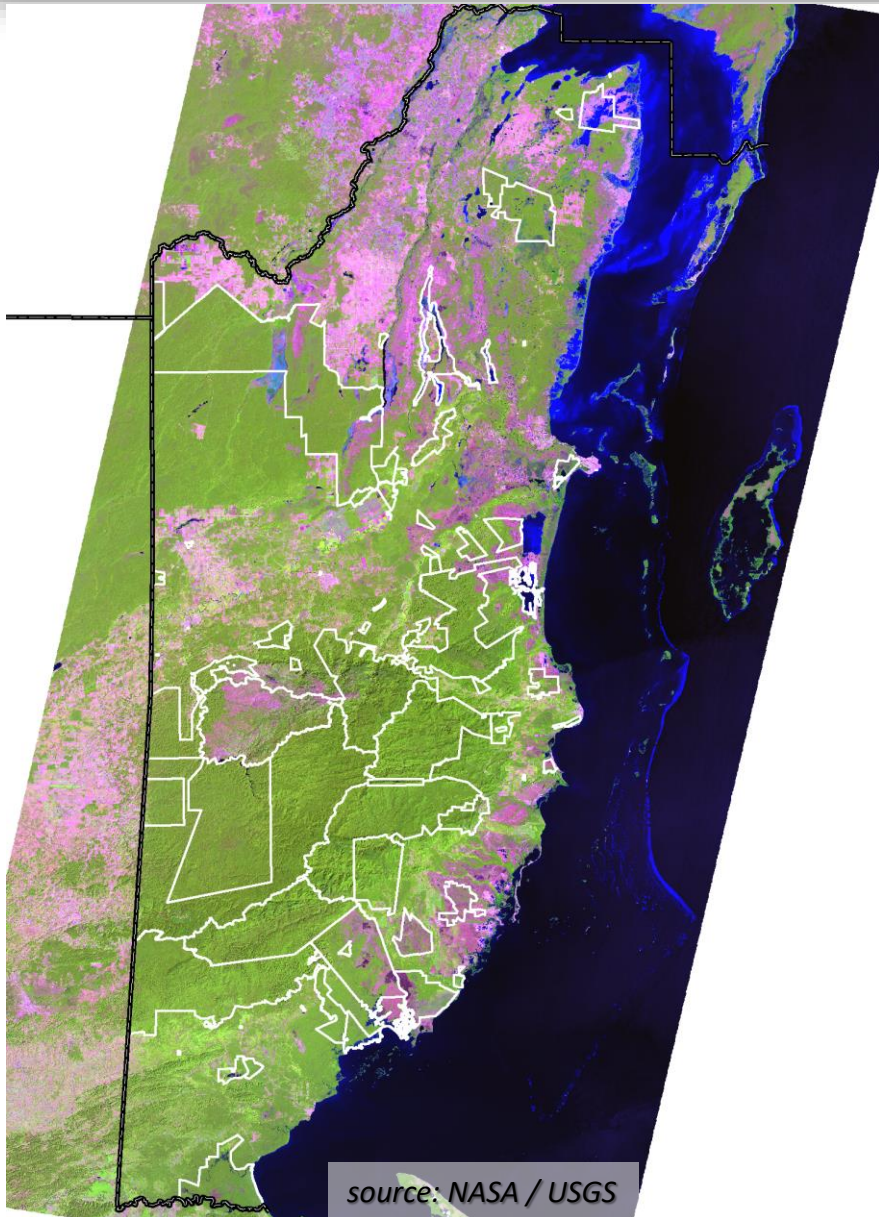


source: NASA / USGS



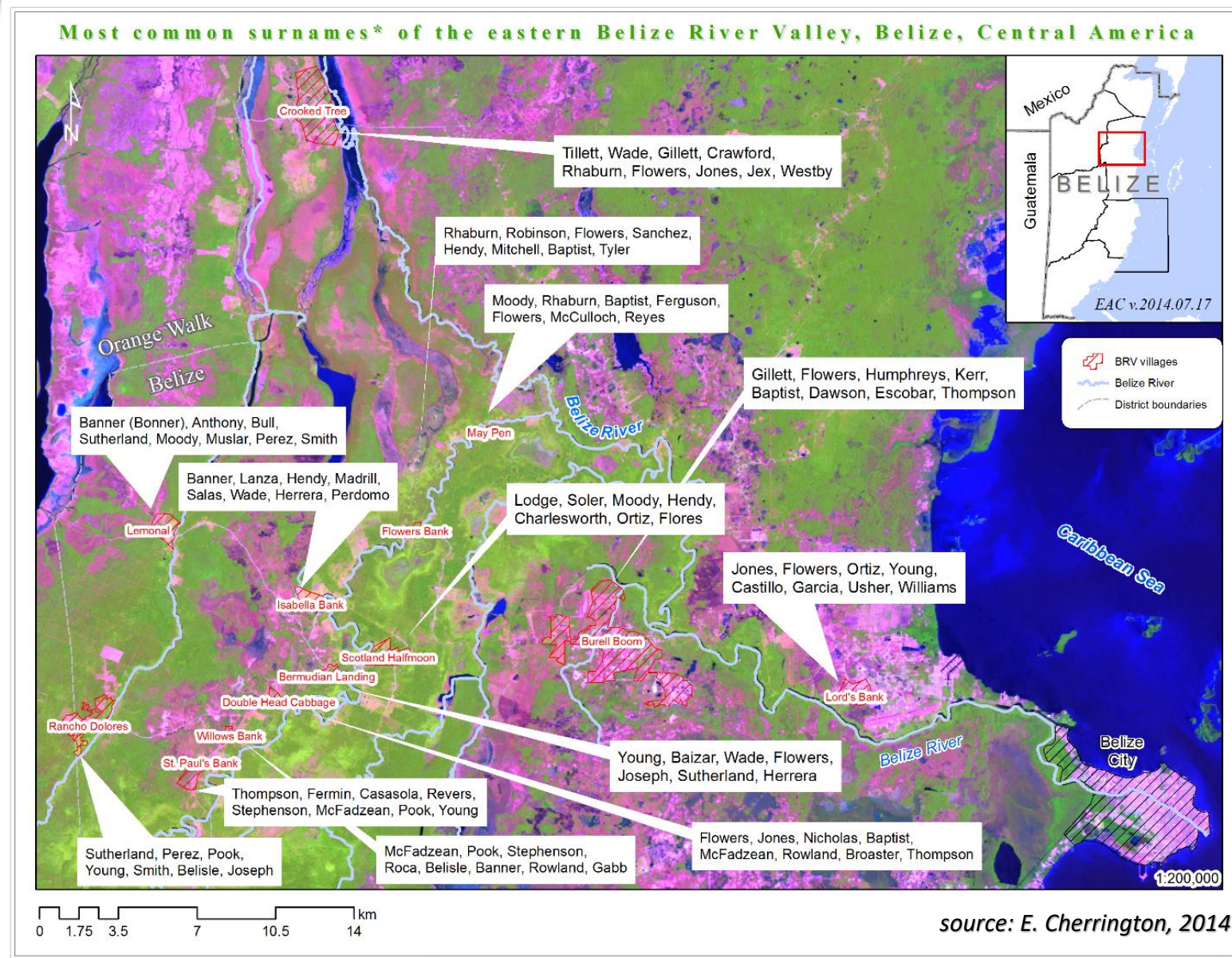
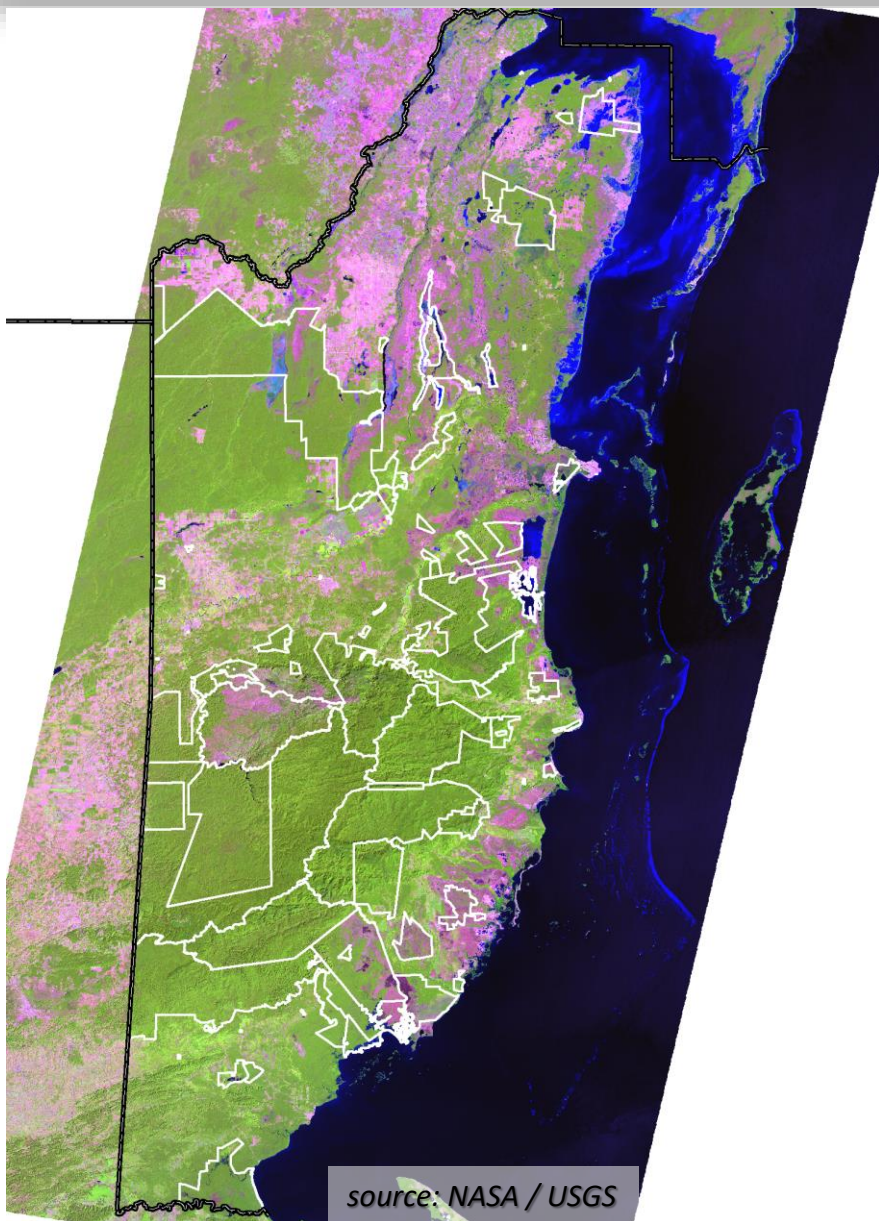
Satellite imagery also show human influences

11



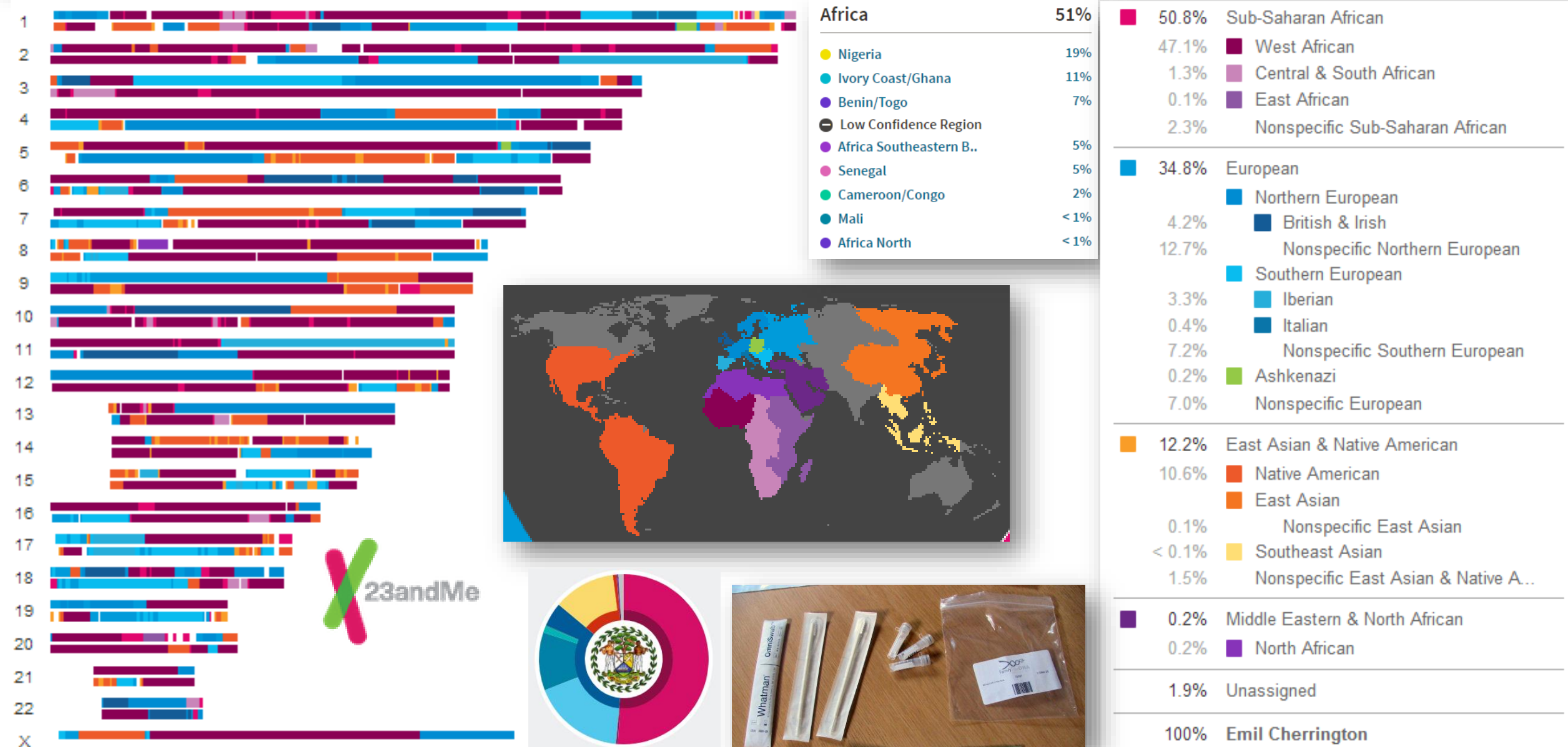
Mosaics: Ecosystems and people

12



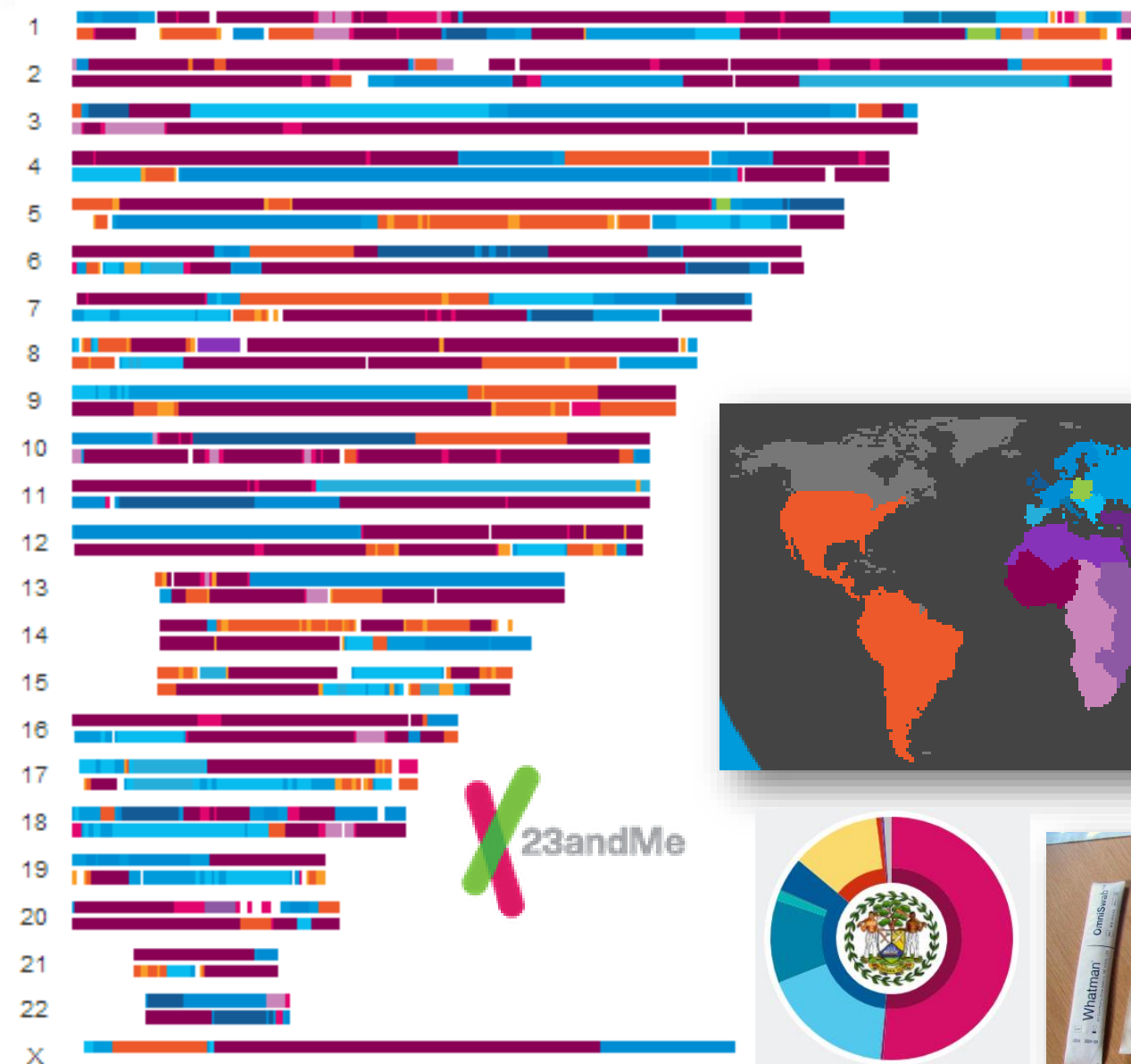
PT 3: Chromosomes can be mapped, as well as continents










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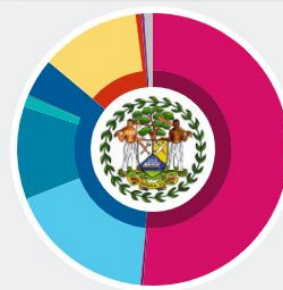
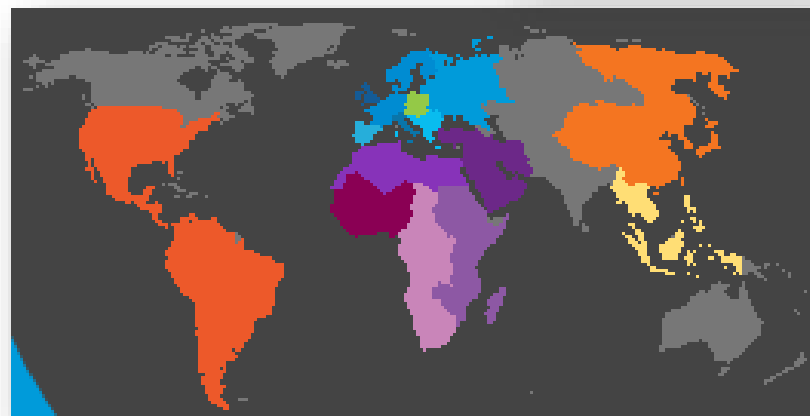


“A typical Belizean genetic profile”

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Africa		51%
 Nigeria		19%
 Ivory Coast/Ghana		11%
 Benin/Togo		7%
 Low Confidence Region		
 Africa Southeastern B..		5%
 Senegal		5%
 Cameroon/Congo		2%
 Mali		< 1%
 Africa North		< 1%



50.8%	Sub-Saharan African
47.1%	West African
1.3%	Central & South African
0.1%	East African
2.3%	Nonspecific Sub-Saharan African
34.8%	European
	<ul style="list-style-type: none"> Northern European British & Irish Nonspecific Northern European Southern European Iberian Italian Nonspecific Southern European Ashkenazi Nonspecific European
12.2%	East Asian & Native American
10.6%	Native American
	East Asian
0.1%	Nonspecific East Asian
< 0.1%	Southeast Asian
1.5%	Nonspecific East Asian & Native A...
0.2%	Middle Eastern & North African
0.2%	North African
1.9%	Unassigned
100%	Emil Cherrington

Genetic data also needs validating

“...Remote sensing w/o validation is remote nonsense.”

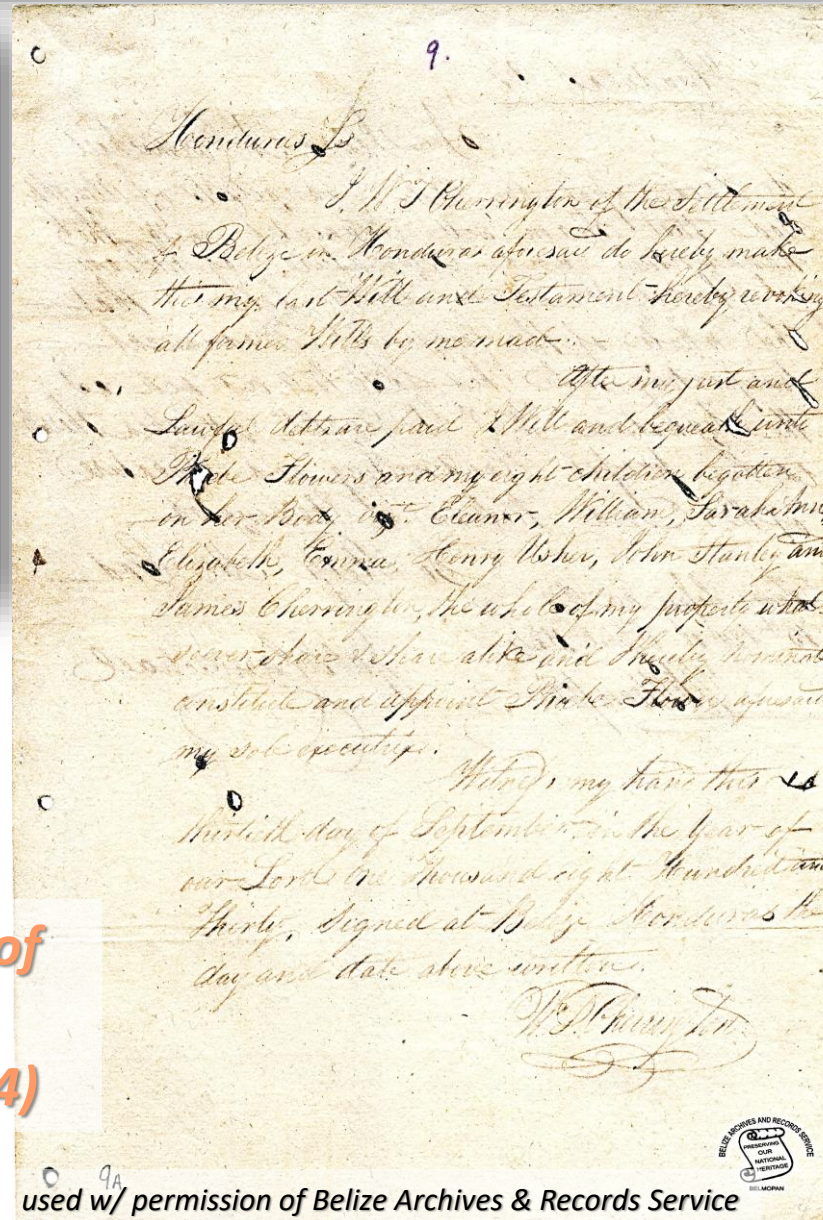
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Big up the Belize Archives & Records Service!



1832 will & testament of
Lt. Col. William Taylor
Cherrington (1777-1834)



used w/ permission of Belize Archives & Records Service

Gen. 1	Gen. 2 Parents	Gen. 3 Grand- parents	Generation 4 1 st Great-Grandparents	Generation 5 2 nd Great-Grandparents	Generation 6 3 rd Great-Grandparents	Generation 7 4 th Great-Grandparents		
Emil A. Cherrington ^[1]	Glenn A. Cherrington ^[2]	Herman Alexander Cherrington ^[4]	Josiah Cherrington ^[8]	William Cherrington III ^[16]	William Cherrington II ^[12]	William Taylor Cherrington ^[64]		
				? ^[33]	Phoebe Flowers ^[65]	4G GrFather ^[66]		
			Eusebia Josefa Yelaya ^[5]	Elizabeth Mahela ^[17]	John Mahela ^[24]	4G GrMother ^[67]	? Mahela ^[40]	4G GrMother ^[69]
				Sabino Yelaya ^[18]	Cyriaco Yelaya Herrera ^[36]	? Yelaya ^[72]	4G GrFather ^[70]	4G GrMother ^[71]
					3G GrMother ^[27]	? Herrera ^[73]	4G GrMother ^[75]	
					Delfina Salvador ^[19]	Cesario Salvador ^[28]	? Salvador ^[78]	4G GrMother ^[77]
		3G GrMother ^[29]				4G GrFather ^[79]	4G GrFather ^[78]	
		Anyline Albertha Young ^[5]		William Young (?) ^[20]	3G GrFather ^[40]	4G GrFather ^[80]	4G GrMother ^[81]	4G GrFather ^[82]
			3G GrMother ^[41]		4G GrMother ^[83]	4G GrFather ^[84]	4G GrMother ^[85]	
			Janet Flowers (?) ^[21]	3G GrFather ^[42]	4G GrFather ^[86]	4G GrMother ^[87]	4G GrFather ^[88]	
				3G GrMother ^[43]	4G GrMother ^[89]	4G GrFather ^[90]	4G GrMother ^[91]	
				? Ortega ^[22]	3G GrFather ^[44]	4G GrFather ^[92]	4G GrMother ^[93]	4G GrFather ^[94]
					3G GrMother ^[45]	4G GrMother ^[95]	4G GrFather ^[96]	4G GrMother ^[97]
		Ramsay G.F.C. Leacock ^[6]	Karl Stanislaus Heusner ^[12]	Jacob Heusner ^[24]	? Heusner ^[40]	4G GrFather ^[98]	4G GrMother ^[99]	4G GrFather ^[100]
				Emilie (<i>Amelia</i>) Helena Strack-Heusner ^[25]	? ^[49]	4G GrMother ^[99]	4G GrFather ^[101]	4G GrMother ^[102]
					Carl Wilhelm August Strack ^[50]	4G GrFather ^[103]	4G GrMother ^[104]	4G GrFather ^[105]
				Helena Gertrud Strack ^[51]	4G GrMother ^[106]	4G GrFather ^[107]	4G GrMother ^[108]	
				John ^[7] ^[26]	? ^[52]	4G GrFather ^[104]	4G GrMother ^[105]	4G GrFather ^[106]
	? ^[53]				4G GrMother ^[106]	4G GrFather ^[107]	4G GrMother ^[108]	
	Avis Viola Peters-Leacock ^[13]		Mabel Peters ^[27]	Frederick Peters ^[54]	? Peters ^[100]	4G GrFather ^[109]	4G GrMother ^[110]	
				Carmen Lorian Flores ^[55]	? Lorian ^[110]	4G GrFather ^[111]	4G GrMother ^[112]	
			? Encalada ^[28]	? ^[57]	4G GrFather ^[112]	4G GrMother ^[113]	4G GrFather ^[114]	
				? Mejia ^[58]	4G GrMother ^[115]	4G GrFather ^[116]	4G GrMother ^[117]	
				David Emmanuel Bood ^[30]	? ^[59]	4G GrFather ^[118]	4G GrMother ^[119]	4G GrFather ^[120]
					? Bood ^[60]	4G GrFather ^[121]	4G GrMother ^[122]	4G GrFather ^[123]
	Rita E. Encalada-Leacock ^[7]	Alejandro Encalada ^[14]	? Cabral ^[61]	4G GrFather ^[124]	4G GrMother ^[125]	4G GrFather ^[126]		
			? Vaccaro ^[62]	4G GrFather ^[127]	4G GrMother ^[128]	4G GrFather ^[129]		
		Cristobel Vaccaro ^[31]	Catherine ?-Vaccaro ^[63]	4G GrFather ^[130]	4G GrMother ^[131]	4G GrFather ^[132]		
			? ^[64]	4G GrFather ^[133]	4G GrMother ^[134]	4G GrFather ^[135]		
				? ^[65]	4G GrFather ^[136]	4G GrMother ^[137]	4G GrFather ^[138]	
			? ^[66]		4G GrFather ^[139]	4G GrMother ^[140]	4G GrFather ^[141]	

Like understanding reflectance, family history is its own puzzle



Big up the Belize Archives & Records Service!



1832 will & testament of Lt. Col. William Taylor Cherrington (1777-1834)

9.

Memorandum

I, W. T. Cherrington of the Settlement of Belize in Honduras do hereby make this my last Will and Testament hereby revoking all former Wills by me made.

After my just and lawful debts paid I will and bequeath unto Phoebe Flowers and my eight children begotten in her body viz. Eleanor, William, Sarah Ann, Elizabeth, Emma, Henry Wsher, John Stanley and James Cherrington, the whole of my property which I now have and shall hereafter acquire and appoint Phoebe Flowers and my sole executrix.

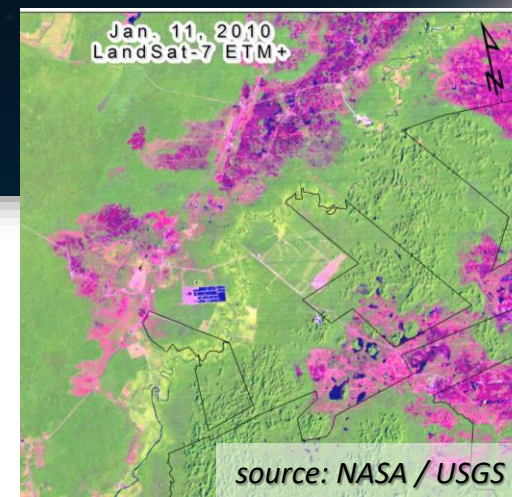
Witness my hand this 16th day of September in the year of our Lord one thousand eight hundred and thirty, signed at Belize Honduras the day and date above written.

W. T. Cherrington

used w/ permission of Belize Archives & Records Service

Gen. 1	Gen. 2 Parents	Gen. 3 Grand-parents	Generation 4 1st Great-Grandparents	Generation 5 2nd Great-Grandparents	Generation 6 3rd Great-Grandparents	Generation 7 4th Great-Grandparents
Emil A. Cherrington ^[1]	Glen A. Cherrington ^[2]	Herman Alexander Cherrington ^[4]	Josiah Cherrington ^[8]	William Cherrington III ^[16]	William Cherrington II ^[12]	William Taylor Cherrington ^[64] Phoebe Flowers ^[65] 4G GrFather ^[66] 4G GrMother ^[67]
				Elizabeth Mahela ^[17]	John Mahela ^[24]	? Mahela ^[40] 4G GrMother ^[69] 4G GrFather ^[70] 4G GrMother ^[71]
			Eusebia Josefa Yelaya ^[5]	Sabino Yelaya ^[18]	Cyriaco Yelaya Herrera ^[36]	? Yelaya ^[72] ? Herrera ^[73] 4G GrFather ^[74] 4G GrMother ^[75]
		Anyline Albertha Young ^[5]		Delfina Salvador ^[19]	Cesario Salvador ^[28]	? Salvador ^[76] 4G GrMother ^[77] 4G GrFather ^[78] 4G GrMother ^[79]
			James Young ^[10]	William Young (?) ^[20]	3G GrFather ^[40]	4G GrFather ^[80] 4G GrMother ^[81] 4G GrFather ^[82] 4G GrMother ^[83]
				Janet Flowers (?) ^[21]	3G GrMother ^[41]	4G GrFather ^[84] 4G GrMother ^[85] 4G GrFather ^[86] 4G GrMother ^[87]
	Emelia E. Leacock-Cherrington ^[3]	Ramsay G.F.C. Leacock ^[6]	Fernanda Ortega ^[11]	? Ortega ^[22]	3G GrFather ^[44]	4G GrFather ^[88] 4G GrMother ^[89] 4G GrFather ^[90] 4G GrMother ^[91]
				? [23]	3G GrMother ^[45]	4G GrFather ^[92] 4G GrMother ^[93] 4G GrFather ^[94] 4G GrMother ^[95]
			Karl Stanislaus Heusner ^[12]	Jacob Heusner ^[24]	? Heusner ^[40]	4G GrFather ^[96] 4G GrMother ^[97] 4G GrFather ^[98] 4G GrMother ^[99]
		Avis Viola Peters-Leacock ^[13]		Emilie (Amelia) Helena Strack-Heusner ^[25]	Carl Wilhelm August Strack ^[30]	Wilhelm Strack ^[100] Gertrud Mosblech ^[101] Michael Strack ^[102] Anna Strack ^[103]
				John ? [26]	? [52]	4G GrFather ^[104] 4G GrMother ^[105] 4G GrFather ^[106] 4G GrMother ^[107]
				Mabel Peters ^[27]	? [53]	? Peters ^[108] 4G GrMother ^[109] ? Loriano ^[110] ? Flores ^[111]
	Rita E. Encalada-Leacock ^[7]	Alejandro Encalada ^[14]	? Encalada ^[28]	? Encalada ^[54]	? Encalada ^[54]	4G GrFather ^[112] 4G GrMother ^[113] 4G GrFather ^[114] 4G GrMother ^[115]
			Catalina Mejia ^[29]	? Mejia ^[58]	? [59]	4G GrFather ^[116] 4G GrMother ^[117] 4G GrFather ^[118] 4G GrMother ^[119]
		Aileen Bood ^[15]		David Emmanuel Bood ^[30]	? Bood ^[60]	4G GrFather ^[120] 4G GrMother ^[121] 4G GrFather ^[122] 4G GrMother ^[123]
					? Cabral ^[61]	4G GrFather ^[124] 4G GrMother ^[125] 4G GrFather ^[126] 4G GrMother ^[127]
				Cristobal Vaccaro ^[31]	? Vaccaro ^[62]	4G GrFather ^[128] 4G GrMother ^[129]
					Catherine ?-Vaccaro ^[63]	4G GrFather ^[130]

Landscapes speak to us



18

Certificate of Marriage.

No.	When and where married.	Name and Surname.	Under or above the age of 21 years.	Condition.*	Rank or Profession.	Residence at time of Marriage.	Father's Name and Surname.	Rank or Profession of Father.
637	January 18 th 1882	William Cherrington	above	Bachelor	Shipwright	Belize	William Cherrington (deceased)	
		Elizabeth Mahica	above	Spinster		Belize	John Mahica (deceased)	

Married in the Wesley Chapel, Belize according to the rites and ceremonies of the Wesleyan Church by me after oath or declaration duly made as by law required.

This marriage was solemnized between us { William Cherrington } in the presence of { Elizabeth Mahica } of { Belize }

By me, BERTIE HOSCHER, 18th day of January 1882.

* Bachelor, Spinster, Widower, or Widow.

Page 4

854. MARRIAGE solemnized at the Wesleyan Chapel Belize in the Settlement of Bondville in the County of Belize.

No.	When Married.	Name and Surname.	Age.	Condition.	Rank, or Profession.	Residence at time of Marriage.	Father's Name and Surname.	Rank or Profession of Father.
61	January 18 th 1882	William Cherrington	above	Bachelor	Shipwright	Belize	William Cherrington (deceased)	
		Elizabeth Mahica	above	Spinster		Belize	John Mahica (deceased)	

Married in the Wesleyan Chapel according to the Rites and Ceremonies of the Wesleyan Church by me after oath or declaration duly made as by law required.

This Marriage was solemnized between us { William Cherrington } in the presence of { Elizabeth Mahica } of { Belize }

By me, BERTIE HOSCHER, 18th day of January 1882.

* Bachelor, Spinster, Widower, or Widow.



Certificate of Marriage.

No.	When and where married.	Name and Surname.	Under or above the age of 21 years.	Condition.*	Rank or Profession.	Residence at time of Marriage.	Father's Name and Surname.	Rank or Profession of Father.
1079	January 19 th 1882	Alfred Allen	above	Bachelor	Provisioner	Belize	Father dead	
		Amelia Jones	above	Spinster		Belize	Father dead	

Married in the Wesley Chapel Belize according to the rites and ceremonies of the Wesleyan Methodist by me after oath or declaration duly made as by law required.

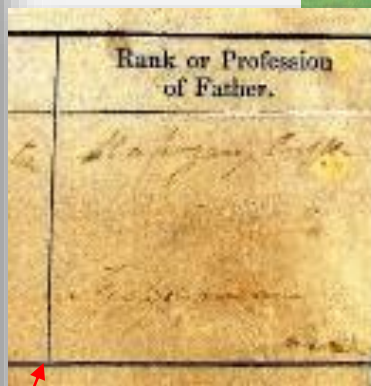
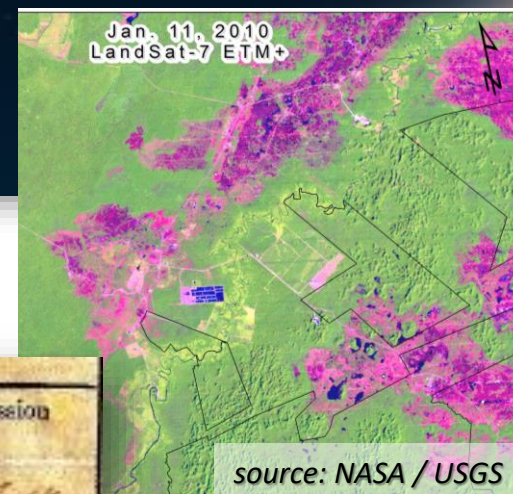
This marriage was solemnized between us { Alfred Allen } in the presence of { Amelia Jones } of { Belize }

By me, BERTIE HOSCHER, 19th day of January 1882.

* Bachelor, Spinster, Widower, or Widow.

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Archives & Records Service

...The woodcutters' descendant



The University of Washington

The Regents of the University on recommendation of the Faculty and by virtue of the Authority vested in them by Law have conferred upon

Emil Alexander Cherrington

the degree of

Master of Science

and have granted all the Rights, Privileges and Honors thereto pertaining Given at Seattle, in the State of Washington, this eleventh Day of June, Two Thousand and Four, in the One Hundred and forty-fourth Year of the University.



President of the University
Charles L. Pearson
Acting Dean, Graduate School



The Faculty of Environmental Sciences

The Faculty hereby confers upon

Mr

Emil Alexander Cherrington, MSc.

born in Belize City, Belize, on 10 December 1980

the academic degree

Doctor rerum silvaticarum
(Dr. rer. silv.)

after the candidate proved his scientific competence in a joint German-French PhD programme in collaboration with AgroParisTech (Erasmus-Mundus-Programm FONASO - Forest and Nature for Society) based upon

Towards ecologically consistent remote sensing mapping of tree communities in French Guiana:
Are forest types identifiable from spatio-temporal canopy reflectance patterns?

He earned the final grade
magna cum laude (very good).

Dresden, 14 December 2016

The Rector

The Dean

(embossed seal)
Prof. Dr.-Ing. habil. DEng/Auckland
Dr. h.c./Brno, Dr. h.c./Dankook
Hans Müller-Steinhagen

Prof. Dr. rer. nat.
Karl-Heinz Feger

Page 4

854. MARRIAGE solemnized at the Wesleyan Chapel Belize in the Settlement of Belize in the County of

No.	When Married.	Name and Surname	Age	Condition.	Rank, or Profession.	Residence at date of Marriage.	Father's Name and Surname.	Rank or Profession of Father.
61	January fifth 1854	Emil Alexander Cherrington	28	Single	None	Belize	Emil Alexander Cherrington	None

Married in the Wesleyan Chapel according to the Rites and Ceremonies of the Wesleyan Methodists, by

By me, *Henry Hoker Cherrington* Minister.

This Marriage was solemnized and witnessed us, *Henry Hoker Cherrington* Registrar.

in the Presence of us, *Henry Hoker Cherrington*

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Conclusion: This is also *your* story!

20



SERVIR-Himalaya
ICIMOD



SERVIR-West Africa
AGHRYMET,
ACMAD, AFRIGIST,
CERSGIS, CSE, and ICRISAT



SERVIR-Science Coordination Office,
Applied Sciences Team,
SERVIR Support Team



SERVIR-Eastern &
Southern Africa
RCMRD



SERVIR-Mekong
ADPC
SIG, SEI and Deltares

Gen	# Ancestors	Year	Description
1	2	1955	Parents
2	4	1930	Grandparents
3	8	1900	1g grandparents
4	16	1870	2g grandparents
5	32	1840	3g grandparents
6	64	1810	4g grandparents
7	128	1780	5g grandparents
8	256	1750	6g grandparents
9	512	1720	7g grandparents
10	1,024	1690	8g grandparents
11	2,048	1660	9g grandparents
12	4,096	1630	10g grandparents
13	8,192	1600	11g grandparents
14	16,384	1570	12g grandparents
15	32,768	1540	13g grandparents
16	65,536	1510	14g grandparents
17	131,072	1480	15g grandparents
18	262,144	1450	16g grandparents
19	524,288	1420	17g grandparents
20	1,048,576	1390	18g grandparents
21	2,097,152	1360	19g grandparents
22	4,194,304	1330	20g grandparents
23	8,388,608	1300	21g grandparents
24	16,777,216	1270	22g grandparents
25	33,554,432	1240	23g grandparents
26	67,108,864	1210	24g grandparents
27	134,217,728	1180	25g grandparents
28	268,435,456	1150	26g grandparents
29	536,870,912	1120	27g grandparents
30	1,073,741,824	1090	28g grandparents